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NATIONAL DAM SAFETY PROGRAM. UNIMIN FRESH WATER POND DAM (INVEN--ETC(U)

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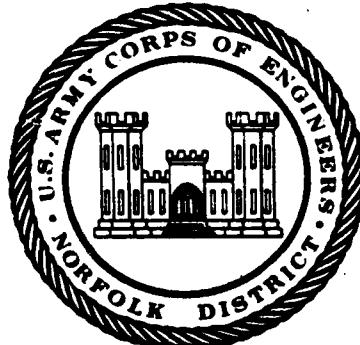
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POTOMAC RIVER BASIN

Name of Dam: Unimin Fresh Water Pond Dam
Location: Frederick County, Commonwealth of Virginia
Inventory Number: VA 06917

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**PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM**



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PREPARED FOR

**NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510**

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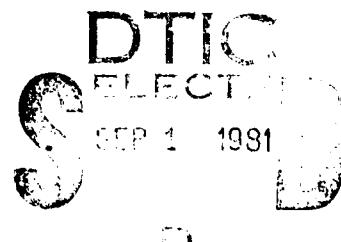
20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Inspection is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspection. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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NAME OF DAM: UNIMIN FRESH WATER POND DAM

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NATIONAL DAM SAFETY PROGRAM

Name of Dam: Unimin Fresh Water Pond Dam
State: Commonwealth of Virginia
County: Frederick
USGS 7.5 Minute Quadrangle: Hayfield, Virginia
Stream: Mine Spring Run
Date of Inspection: 30 and 31 October 1980

BRIEF ASSESSMENT OF DAM

Unimin Fresh Water Pond Dam is a 45.5 foot high¹ by 627 foot long earthfill embankment, with a 40 foot wide vegetated earth emergency spillway located adjacent to the right abutment². The principal spillway consists of a square concrete tower with two rectangular openings, 4.8 and 10.2 feet by 4.4 feet, respectively. The tower connects to a 36-inch diameter outlet pipe. The dam, located approximately 1.1 miles south of Gore, Virginia, is used for water supply by the owner, Unimin Corporation. Unimin Fresh Water Pond Dam is an "intermediate" size - "high" hazard structure as defined by the Recommended Guidelines for Safety Inspection of Dams. The dam and appurtenant structures were found to be in good overall condition at the time of inspection. Past maintenance of the dam has been inadequate. A stability check of the dam is not required.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the Probable Maximum Flood (PMF) was selected as the spillway design flood (SDF). The SDF was routed through the reservoir and found to overtop the dam by a maximum depth of 0.8 feet with an average critical velocity of 4.1 feet per second. Total duration of dam overtopping would be approximately 0.4 hours. The spillway is capable of passing up to 80 percent of the PMF without overtopping the crest of the dam. The spillway is adjudged as inadequate, but not seriously inadequate.

The visual inspection and office analyses indicate no deficiencies requiring emergency attention.

The seep from the rock rubble toe drain should be examined at regular intervals and after periods of heavy rain for turbidity and/or increase in flow, which may indicate the potential for piping of embankment material. If turbidity

¹Measured from the streambed at the downstream toe of the dam to the minimum top of the dam.

²Facing downstream.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

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and/or increased flows are noted, a qualified geotechnical engineering firm should be retained to perform a stability check of the dam. A warning system and emergency action plan should be developed and implemented as soon as possible.

Regular inspections should be made of the dam and appurtenant structures. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be corrected annually.

The following repair items should be accomplished as part of the general maintenance of the dam:

- 1) Remove the saplings from the embankment and in the emergency spillway discharge channel and revegetate the disturbed areas.
- 2) Seed all areas of sparse vegetation on the upstream embankment.
- 3) Add more riprap below the energy dissipator.
- 4) Fill, grade, compact, and revegetate the erosion ditch in the emergency spillway channel.
- 5) Remove the debris and obstructions from the immediate downstream channel.
- 6) Install trash racks to cover the entire inlet openings on the concrete intake tower.
- 7) Install a staff gage to monitor reservoir levels above normal pool.

MICHAEL BAKER, JR., INC. SUBMITTED:

Original signed by

JAMES A. WALSH

James A. Walsh, P.E.
Chief, Design Branch


Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer

RECOMMENDED:

Original signed by
JACK G. STARR

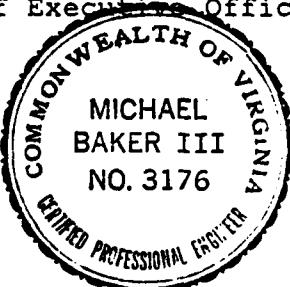
Jack G. Starr, P.E.
Chief, Engineering

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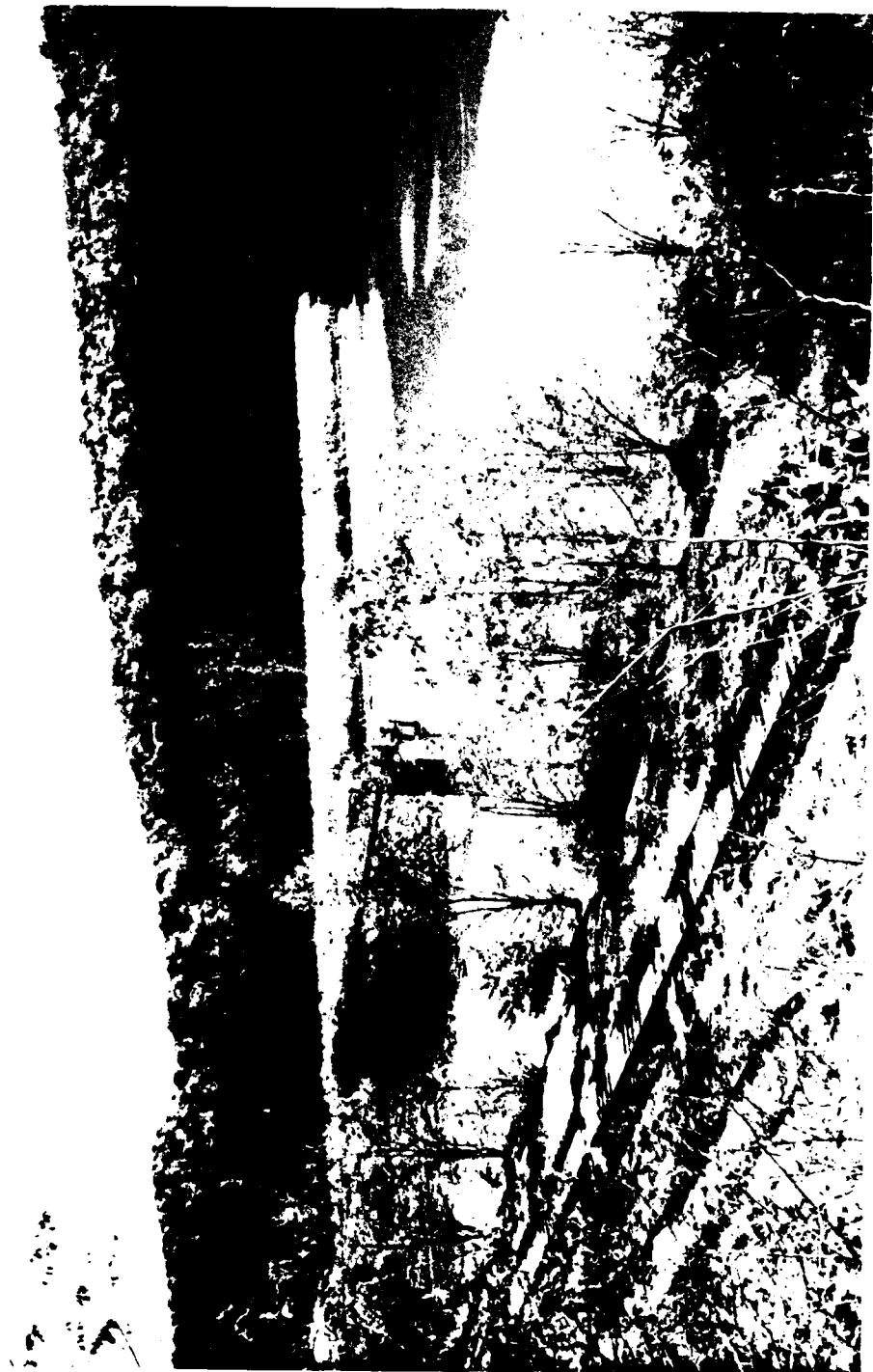
Original signed by:
Douglas L. Haller

Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: JAN 20 1981



NAME OF DAM: UNIMIN FRESH WATER POND DAM



OVERALL VIEW OF DAM

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: UNIMIN FRESH WATER POND DAM ID# VA 06917

SECTION 1 - PROJECT INFORMATION

1.1 General

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: Unimin Fresh Water Pond Dam is an earthfill embankment 45.5 feet high¹ and 627 feet long with a crest width of approximately 13 feet. The upstream embankment slope is 3.1H:1V and the downstream embankment slope is 2.86H:1V (Horizontal to Vertical respectively). Rock rubble lines most of the toe of the embankment and forms a rock toe drain. There is no information available on a cut-off trench or zoning of materials for the embankment. It is not known if the dam is keyed into the foundation and abutments. The minimum elevation of the crest is 1037.7 feet Temporary Bench Mark (T.B.M.)². There is no slope protection on the upstream embankment.

¹Measured from the streambed at the downstream toe of dam to the minimum top of the dam.

²All elevations referenced to a Temporary Bench Mark located on the top of the right wing wall on the downstream side of the concrete impact energy dissipator. The assumed elevation is 1000.0 feet.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

The emergency spillway is a trapezoidal shaped, vegetated open channel located adjacent to the right¹ abutment of the embankment. The principal spillway consists of two rectangular openings in a square shaped concrete intake tower located to the left of the center of the embankment. The crest of the openings are at elevation 1028.0 feet T.B.M. The openings are 4.4 feet high, 4.8 and 10.2 feet long, respectively, with vertical upstream and downstream faces. Water passing through the openings falls into a concrete well and then passes under the dam through a 36 inch diameter concrete pipe. The pipe outlets to a concrete impact type energy dissipator over which the pump house is situated. Water then passes over a 12 foot long concrete weir and flows into a natural stream channel.

1.2.2 Location: Unimin Fresh Water Pond Dam is located on Mine Spring Run, approximately 1.1 miles south of Gore, Virginia. A Location Plan is included with this report as Appendix I.

1.2.3 Size Classification: The height of the dam is 45.5 feet; the reservoir storage capacity at the crest of the dam (elevation 1037.7 feet T.B.M.) is 100 acre-feet. Therefore, the dam is in the "intermediate" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.2.4 Hazard Classification: Three homes are located approximately 4,000 feet downstream of the dam. A business, C.E. Minerals, is located about 5,000 feet downstream and three more homes are located approximately 6,500 feet downstream of the impoundment. There is danger of loss of human life from large flows downstream of the dam. Therefore, Unimin Fresh Water Pond Dam is considered in the "high" hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams. The hazard classification used to categorize dams is a function of location only and is not related to its stability or probability of failure.

¹Facing downstream.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

1.2.5 Ownership: The dam and reservoir are owned by Unimin Corporation, P.O. Box 38, Gore, Virginia 22637.

1.2.6 Purpose of Dam: The reservoir is used for water supply for Unimin Corporation.

1.2.7 Design and Construction History: No information on the design and construction history was available. According to information supplied by the owner's representative, there is no design or construction information available.

1.2.8 Normal Operational Procedures: The reservoir is normally maintained at the elevation of the spillway weir crest at elevation 1028.0 feet T.B.M. No formal operating procedures are followed for this structure.

1.3 Pertinent Data

1.3.1 Drainage Area: The total drainage area of Mine Spring Run at the dam is 2.66 square miles. However, 2.03 square miles of the drainage area are totally controlled by the Tailings Dam upstream. Flow from the spillway of the Unimin Tailings Dam exits into a separate drainage basin bypassing the watershed contributing to the Unimin Fresh Water Dam. Therefore, only 0.63 square miles of drainage area contribute flood flow to the Unimin Fresh Water Pond Dam.

1.3.2 Discharge at Dam Site: The maximum discharge from the reservoir is unknown.

Spillway
Pool level at top of dam . . . 4869 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are provided in the following table:

NAME OF DAM: UNIMIN FRESH WATER POND DAM

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation (feet T.B.M.)	Area (acres)	Reservoir Capacity		
			Acre- feet	Watershed (inches)	Length (feet)
Top of dam	1037.7	7.3	100	0.7	1600
Prinicpal spillway crest (normal pool)	1028.0	4.6	43	0.3	700
Streambed at toe of dam	992.2	-	-	-	-

NAME OF DAM: UNIMIN FRESH WATER POND DAM

SECTION 2 - ENGINEERING DATA

- 2.1 Design: Design plans, specifications, or boring logs were not available for use in preparing this report. No stability analyses or hydrologic and hydraulic data were available for review.
- 2.2 Construction: Construction records, as-built plans, and inspection logs were not available for review.
- 2.3 Evaluation: No construction records or as-built plans were available to adequately assess the condition of the dam. All evaluations and assessments in this report were based upon field observations, conversations with representatives of the owner, and office analyses.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

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SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The field inspection was conducted on 30 and 31 October 1980. At the time of the inspection, the pool elevation was at 1022.7 feet T.B.M. and the tailwater elevation was 994.1 feet T.B.M. The weather was clear and cool with temperatures in the low 50's (degrees Fahrenheit). The ground surface at the embankment and abutments was generally dry. The dam and appurtenant surfaces were found to be in fair to good overall condition at the time of the inspection. Deficiencies found during the inspection are not believed to indicate any major stability problems, although they will require remedial treatment. The following are brief summaries of deficiencies found during the inspection. A Field Sketch of conditions is presented as Plate 1 in Appendix I. The complete visual inspection check list is provided in Appendix III. No record was found of any previous inspections.

3.1.2 Dam: The embankment was found to be in generally good condition, with no surface cracks or sloughs. Approximately 30 percent of the upstream embankment is sparsely vegetated and has minor erosion from wave action (see Photo 1). The downstream embankment is heavily vegetated, has a few saplings, and is only very slightly eroded. The junctions of the embankment and abutments appear to be in good condition, with no evidence of erosion.

Coarse rock rubble lines most of the toe of the dam and forms a rock toe drain (see Photo 2). No drain outlets were found. A small seep is located to the right of the principal spillway outlet (see Photo 3).

3.1.3 Appurtenant Structures: The principal spillway for the dam is a square shaped concrete tower with a spillway intake consisting of two rectangular openings with crests at elevation 1028.0 feet T.B.M. (see Photo 4).

NAME OF DAM: UNIMIN FRESH WATER POND DAM

The openings have vertical upstream and downstream faces; are located on the reservoir and emergency spillway sides of the concrete tower; and are 4.8 feet and 10.2 feet long by 4.4 feet high, respectively. Trash racks partially cover the openings. Water flowing through the openings falls into a concrete well and then passes under the dam through a 36 inch diameter concrete pipe. The pipe outlets to a concrete impact type energy dissipator with a pump house constructed on top (see Photo 5). Water then passes over a 12 foot long concrete weir and flows into a natural stream channel. The concrete in the intake tower and outlet dissipator appears to be in good condition, with no visible cracking or spalling of the concrete.

Three "Rodney Hunt" liftgates are located on the concrete intake tower (see Photo 4). Two liftgates are intakes for the water supply sump, and the third is a drawdown gate for dewatering the reservoir. Controls for the lifts are located on top of the concrete intake tower and are reached by means of a steel catwalk extending out from the upstream top of the dam to the intake tower. The liftgates are in good condition.

The emergency spillway is a vegetated earth, trapezoidal channel adjacent to the right abutment of the dam (see Photo 6). The bottom width at the center of the dam is 40 feet. The approach channel is broad and unobstructed. The spillway is well vegetated with grass except where the shale cut is exposed. Although vegetation over the shale is sparse, no significant erosion or sloughing has occurred, nor does it appear likely. The discharge channel is well defined downstream of the dam. It has a small ditch eroded to bedrock, but is not a hazard to the dam (see Photo 7). Overall, the spillway appears to be in good condition.

3.1.4 Reservoir Area: The reservoir slopes are steep and wooded, except where mining operations are in progress (see Photos 6 and 8). The slopes that are wooded are in good condition, with no evidence of erosion. The

NAME OF DAM: UNIMIN FRESH WATER POND DAM

slopes situated among mining operations are heavily eroded. This has resulted in some sedimentation buildup in the reservoir in this area. Sediment buildup does not appear to be extensive near the dam. Soundings near the intake tower indicate the water depth to be approximately 18 feet below the pool level measured during the inspection in that location.

3.1.5 Downstream Channel: The downstream channel is a natural stream channel, known as Mine Spring Run, which drains into Back Creek at the town of Gore. There is some minor debris and miscellaneous junked items present in the natural channel immediately downstream of the dam.

3.1.6 Instrumentation: There is no instrumentation present at the dam.

3.2 Evaluation: In general, the dam and appurtenant structures are in good condition. The saplings on the embankment should be cut off and an adequate grass cover should be established over the disturbed area. All areas of sparse vegetation on the upstream embankment should be seeded.

All brush in the discharge channel should be cut off at ground level and the erosion ditch should be filled, graded, compacted, and all disturbed areas revegetated. Additional riprap should be added below the energy dissipator. The seep from the rock toe drain should be examined at regular intervals and after periods of heavy rain for turbidity and/or increase in flow, which may indicate the potential for piping of embankment material. If turbidity and/or increased flows are noted, a qualified geotechnical engineering firm should be retained to perform a stability check of the dam. The debris and obstructions should be removed from the downstream channel. Additional riprap is needed below the dissipator. A staff gage should be installed to monitor reservoir levels above normal pool. Trash racks should be installed to cover the entire inlet openings on the concrete intake tower.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

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SECTION 4 - OPERATIONAL PROCEDURES

- 4.1 Procedures: Operation of the dam is an automatic function controlled by the principal spillway and the emergency spillway. Water entering the reservoir flows into the principal spillway at elevation 1028.0 feet T.B.M. When inflow is sufficient, the reservoir level rises above elevation 1029.0 feet T.B.M. and discharges through the emergency spillway.
- 4.2 Maintenance of Dam: Maintenance of the dam is the responsibility of the owner. The dam is visually inspected by the owner's representative on a regular basis, but no formal inspection or maintenance schedule has been instituted.
- 4.3 Maintenance of Operating Facilities: There are numerous operating facilities connected with the dam, however, these are part of the water delivery system. The only facility that affects the dam's hydraulic performance is the liftgate for the emergency drain. Maintenance of these facilities is the responsibility of the owner. A formal inspection or maintenance schedule has not been instituted, although the delivery system receives regular attention.
- 4.4 Warning System: At the present time, there is no warning system or emergency action plan in operation.
- 4.5 Evaluation: Maintenance of the dam in the past has been inadequate. Regular inspections should be made of the dam and appurtenant structures. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be corrected annually. A warning system and emergency action plan should be developed and implemented as soon as possible.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

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SECTION 5 - HYDRAULIC/HYDROLOGIC DATA*

5.1 Design: No design data were available for use in preparing this report.

5.2 Hydrologic Records: No rainfall, stream gage, or reservoir stage records are maintained for this dam.

5.3 Flood Experience: No records were available.

5.4 Flood Potential: The Probable Maximum Flood (PMF) and 1/2 Probable Maximum Flood (1/2 PMF) were developed and routed through the reservoir by use of the HEC-1 DB computer program (Reference 9, Appendix IV) and appropriate unit hydrograph, precipitation, and storage-outflow data. Clark's T_c and R coefficients for the local drainage areas were estimated from basin characteristics. The rainfall applied to the unit hydrograph was taken from a publication by the National Oceanic and Atmospheric Administration (Reference 17, Appendix IV). Rainfall losses for the PMF and 1/2 PMF were estimated at an initial loss of 1.0 inches and a constant loss rate of 0.05 inches per hour thereafter.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are provided in Table 1:1, Paragraph 1.3.3.

The upstream Tailings Dam controls flows for 2.03 square miles of the 2.66 square mile total drainage area. Flow from the spillway of the Unimin Tailings Dam exits into a separate drainage basin bypassing the watershed contributing to the Unimin Fresh Water Pond Dam. Therefore only 0.63 square miles of drainage area contribute flood flow to the Unimin Fresh Water Pond Dam.

Regulation of flow from the reservoir is automatic. Normal flows are maintained by the crest of the principal spillway riser at elevation 1028.0 feet T.B.M. Water also flows past the dam through the emergency spillway when water in the reservoir rises above an elevation of 1029.0 feet T.B.M.

Outlet discharge capacity was computed by hand; reservoir area was estimated from the Hayfield, Virginia, 7.5 minute USGS quadrangle; and storage capacity curves above normal level were computed by the HEC-1 DB program. All flood routings were begun with the reservoir at normal pool. Flow through the principal spillway was included in the routings.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

5.6 Overtopping Potential: The probable rise of the reservoir and other pertinent information on reservoir performance are shown in the following table:

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal ¹	Hydrographs	
		1/2 PMF	PMF ²
Peak flow, c.f.s.			
Inflow	-	3183	6366
Outflow	-	3034	6362
Peak elev., ft. T.B.M.	1028.0	1035.5	1038.5
Emergency spillway ³ (elev. 1029.0 ft. T.B.M.)			
Depth of flow, ft.	-	6.5	9.5
Average velocity, f.p.s.	-	11.0	13.2
Duration of flow, hrs.	-	13.3	25.6
Non-overflow section ³ (elev. 1037.7 ft. T.B.M.)			
Depth of flow, ft.	-	-	0.8
Average velocity, f.p.s.	-	-	4.1
Total duration of over- topping, hrs.	-	-	0.4
Tailwater elev., ft. T.B.M.	994.1	-	-

¹ Conditions at time of inspection.

² The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in a region.

³ Velocity estimates were based on critical depth at control section.

5.7 Reservoir Emptying Potential: The reservoir can be drawn down by means of the drawdown gate lift on the intake tower. It is assumed the drawdown gate is 36 inches in diameter and the invert elevation is 1000.0 feet T.B.M. Neglecting inflow, the reservoir can be drawn down from normal pool in approximately 4.0 hours. This is equivalent to an approximate drawdown rate of 7.0 feet per hour, based on the hydraulic head measured from normal pool divided by the time to de-water the reservoir.

5.8 Evaluation: Unimin Fresh Water Pond Dam is an "intermediate" size - "high" hazard dam requiring evaluation

NAME OF DAM: UNIMIN FRESH WATER POND DAM

for a spillway design flood equal to the PMF. The PMF was routed through the reservoir and found to overtop the dam by a maximum depth of 0.8 feet with an average critical velocity of 4.1 feet per second (f.p.s). Total duration of dam overtopping would be approximately 0.4 hours. The principal and emergency spillways are capable of passing up to 80 percent of the PMF without overtopping the crest of the dam.

Conclusions pertain to present conditions and the effect of future development on the hydrology has not been considered.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: The dam is located in the Valley and Ridge physiographic province of Virginia which is characterized by folded and faulted sedimentary rocks. Ridges with steep slopes generally formed by sandstone or conglomerate, and valleys underlain by limestone, dolomite, or shale are common, with relief of between 500 to 2500 feet. Bedrock underlying the dam specifically consists of middle Devonian age shale (Marcellus shale). The Marcellus shale or shale of the Onondaga formation is exposed in the sidehill cut for the emergency spillway, situated on the east end of the dam and in the emergency spillway discharge channel. The shale in the discharge channel was measured as striking N.35°E and dipping 55°NW. No previous information describing local subsurface conditions was available for the visual inspection or subsequent analyses. It is not known how the dam was keyed into the foundation and abutments.

6.2 Embankment

6.2.1 Materials: Information describing the nature of the embankment materials or any zoning within the dam was not available for this inspection. During the visual inspection, the outer embankment materials were noted as being very shaly. The area located immediately north of the emergency spillway appears to have been a possible source of borrow. As described above, shale is exposed in this area. The embankment materials are expected to be largely silty in nature with abundant shale fragments.

6.2.2 Stability: Design plans and the results of a previous stability analysis were not available for use during this evaluation. The embankment is assumed to be a homogeneous type. The dam is 45.5 feet high with a crest width of approximately 13 feet. The upstream embankment slopes at 3.1H:1V while the downstream embankment slopes at 2.86H:1V. In the event of an emergency, the reservoir can be drawn down due to the availability of an emergency gate and 36 inch diameter drain. According to calculations made as a part of this investigation, the dam is subject to a rapid drawdown

NAME OF DAM: UNIMIN FRESH WATER POND DAM

since the reservoir will drop 7 feet per hour, which exceeds the critical rate for earth dams of 0.5 feet per day.

According to guidelines outlined in Design of Small Dams by the U.S. Department of Interior, Bureau of Reclamation, the upstream slope of a small homogeneous dam constructed of slightly plastic fine grained soils (ML, CL), with a stable foundation, should be 3.5H:1V if subject to rapid drawdown. The recommended downstream slope is 2.5H:1V. A crest width of 19.2 feet is recommended, considering the height of the dam. Based on these guidelines, the upstream slope and crest width are inadequate while the downstream slope is adequate.

Signs of instability in the embankment, such as slumping, tension cracks, or unusual alignment along the crest, were not observed during the visual inspection. Only very slight erosion was detected anywhere on the dam. A seep of approximately 3 to 5 gallons per minute (gpm) was observed at a point to the right of the principal spillway outlet. This seep was discharging from coarse rock rubble that lines most of the toe of the dam and forms a rock toe drain.

6.2.3

Seismic Stability: The dam is located in Seismic Zone 2, which presents no hazard from earthquakes according to the Recommended Guidelines for Safety Inspection of Dams by the Department of the Army, Office of the Chiefs of Engineers. This determination is contingent on the requirements that static stability conditions are satisfactory and conventional safety margins exist.

6.3

Evaluation: The results of a previous stability analysis were not available for review as part of this evaluation of the Unimin Fresh Water Pond Dam. The upstream slope of the dam is slightly steeper than that recommended in the Bureau of Reclamation guidelines. The downstream slope is flatter than recommended. The crest width is approximately 6 feet less than recommended. However, the dam is in good condition and signs of potential instability were absent during the visual inspection. A stability check is therefore not required.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

Also, as described in Section 5 of this report, the dam would be overtopped by the SDF. The SDF would overtop the dam by a maximum depth of 0.8 feet with an average critical velocity of 4.1 f.p.s. Total duration of overtopping would be 0.4 hours. Overtopping flows during the SDF are shallow, last only 0.4 hours, and the velocity does not exceed 6.0 f.p.s., the effective eroding velocity for a vegetated earth embankment. The depth, duration and rate of overtopping flows are not considered detrimental to the embankment.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

BIAWt

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: There were no engineering data available for use in preparing this report. Deficiencies discovered during the field inspection and office analyses require remedial treatment. The dam and appurtenant structures are generally in good condition. Maintenance is considered inadequate. A stability check of the dam is not required.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the PMF was selected as the SDF for the "intermediate" size - "high" hazard classification of Unimin Fresh Water Pond Dam. It has been determined that the dam would be overtopped by the SDF. The depth, duration, and rate of overtopping flows are not considered detrimental to the embankment. Overtopping flows are shallow (0.8 feet), last 0.4 hours, and the velocity (4.1 f.p.s.) is less than 6 f.p.s. which is the effective eroding velocity for a vegetated earth embankment. The principal and emergency spillways together are capable of passing up to 80 percent of the PMF without overtopping the crest of the dam.

The spillway is adjudged as inadequate but not seriously inadequate.

There is no flood warning system or emergency action plan currently in operation.

7.2 Recommended Remedial Measures: The seep from the rock rubble toe drain should be examined at regular intervals and after periods of heavy rain for turbidity and/or increase in flow, which may indicate the potential for piping of embankment material. If turbidity and/or increased flows are noted, a qualified geotechnical engineering firm should be retained to perform a stability check of the dam. A warning system and emergency action plan should be developed and implemented as soon as possible.

Regular inspections should be made of the dam and appurtenant structures. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be corrected annually.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

The following repair items should be accomplished as part of the general maintenance of the dam:

- 1) Remove the saplings from the embankment and in the emergency spillway discharge channel and revegetate the disturbed areas.
- 2) Seed all areas of sparse vegetation on the upstream embankment.
- 3) Add more riprap below the energy dissipator.
- 4) Fill, grade, compact, and revegetate the erosion ditch in the emergency spillway channel.
- 5) Remove the debris and obstructions from the immediate downstream channel.
- 6) Install trash racks to cover the entire inlet openings on the concrete intake tower.
- 7) Install a staff gage to monitor reservoir levels above normal pool.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

APPENDIX I

PLATES

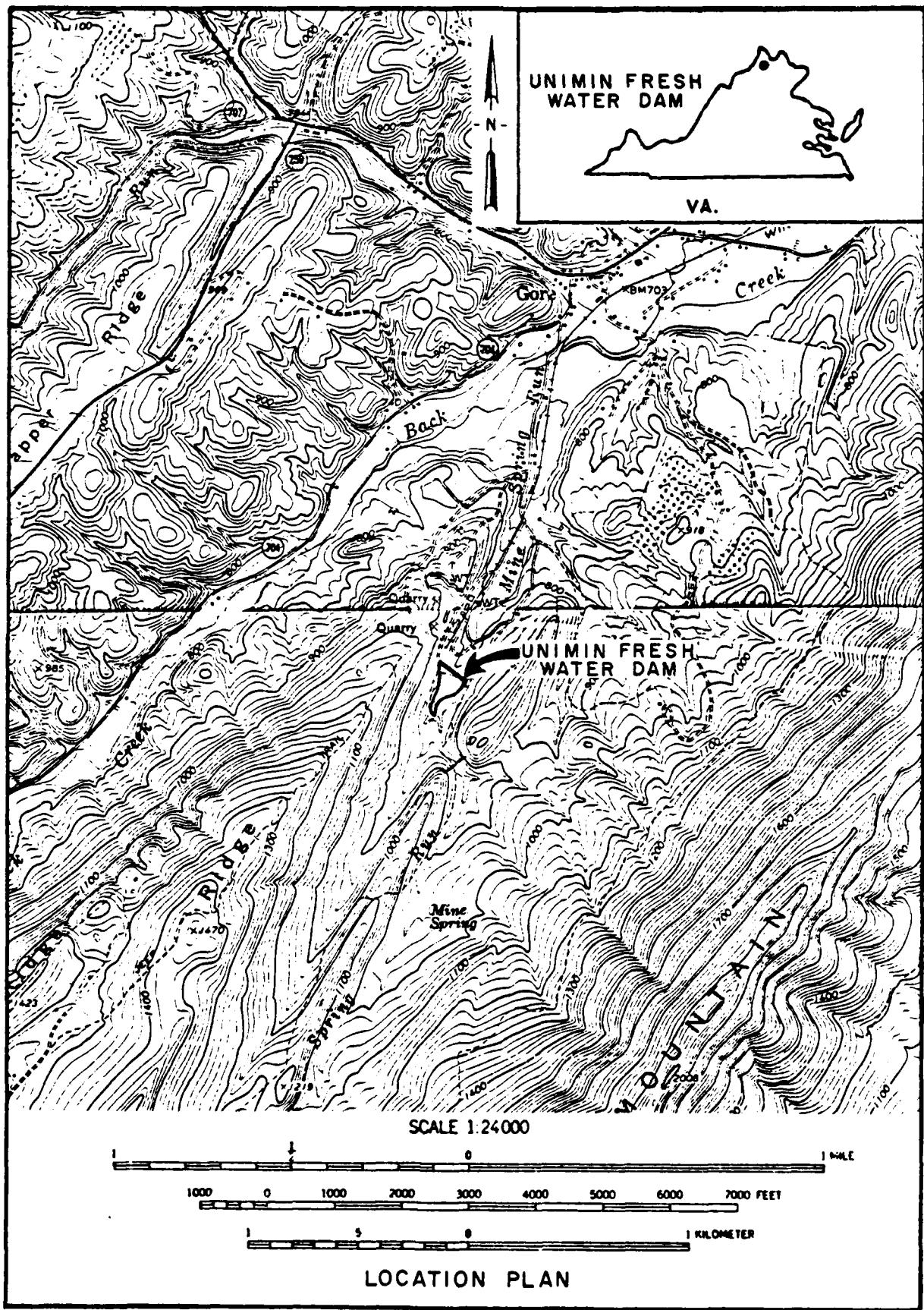
CONTENTS

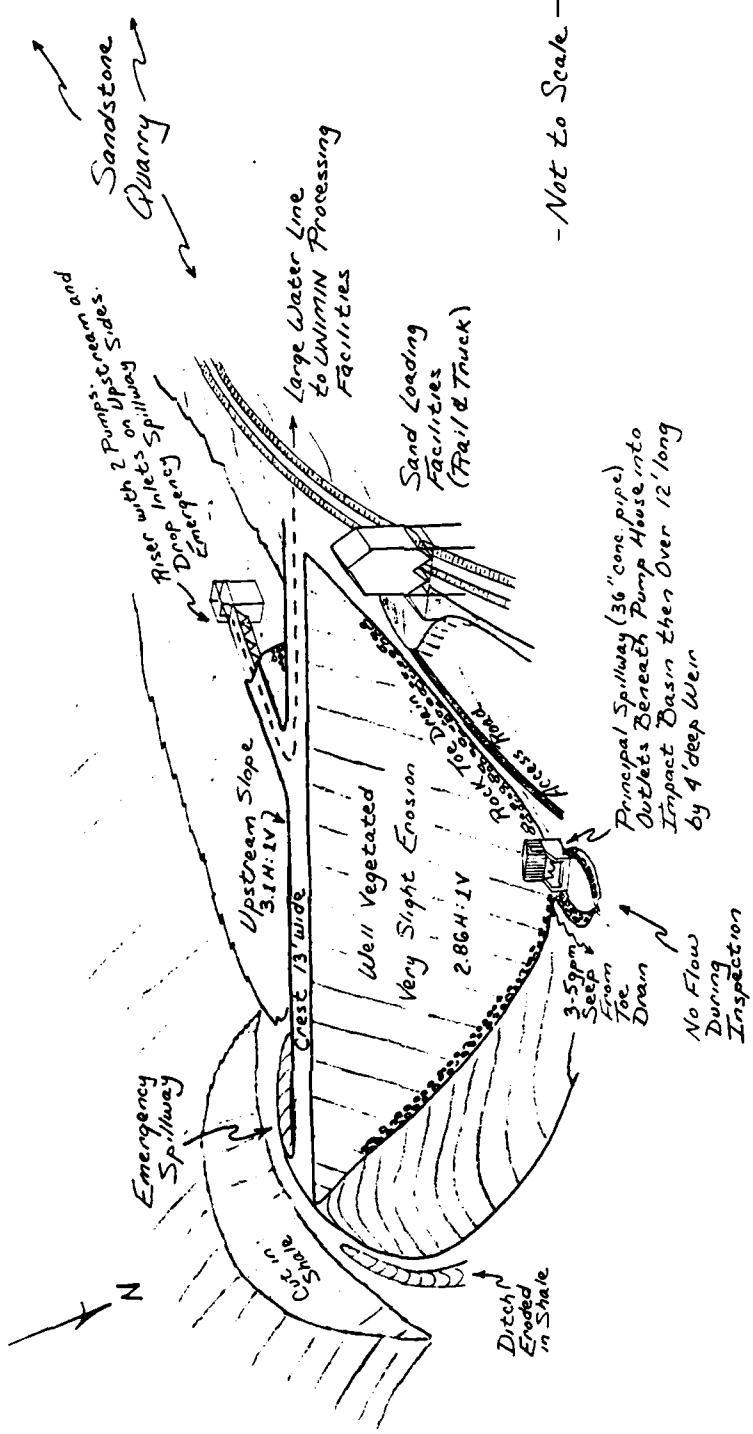
Location Plan

Plate 1: Field Sketch

Plate 2: Top of Dam Profile and Typical Cross Section

NAME OF DAM: UNIMIN FRESH WATER POND DAM





FIELD SKETCH

UNIMIN FRESH WATER DAM, VIRGINIA

Michael Baker, Jr., Inc.

31 October 1980
PLATE 1

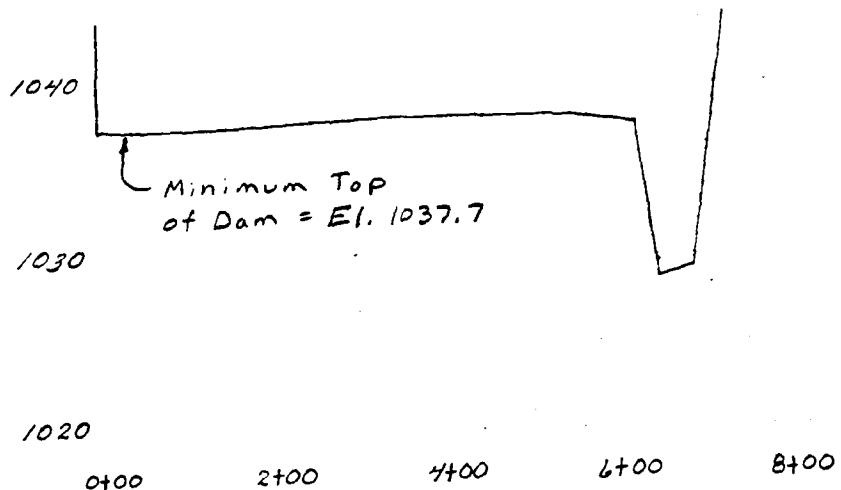
DWH 10-80

MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Top of Dam Profile Looking Downstream



Dam Cross Section Sta. 3+57

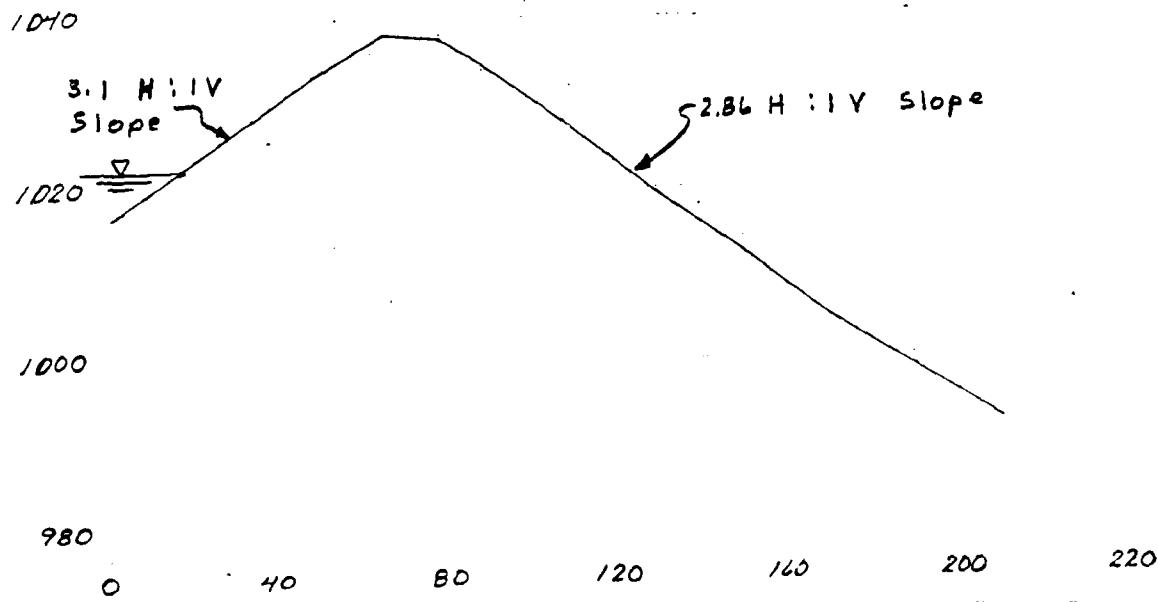


PLATE 2

APPENDIX II

PHOTOGRAPHS

CONTENTS

- Photo 1: Upstream Embankment, Emergency Spillway Approach Channel in Foreground
- Photo 2: Downstream Embankment, Rock Toe Drain
- Photo 3: Seep from Rock Toe Drain
- Photo 4: Riser for Principal Spillway and Pump Platform
- Photo 5: Principal Spillway Outlet
- Photo 6: Emergency Spillway Control Section and Approach Channel
- Photo 7: Erosion of Shale Bedrock in Emergency Spillway Discharge Channel
- Photo 8: Unimin Tailings Dam Upstream of Unimin Fresh Water Impoundment

Note: Photographs were taken on 30 and 31 October 1980.

NAME OF DAM: UNIMIN FRESH WATER POND DAM

UNIMIN FRESH WATER DAM



**PHOTO 1. Upstream Embankment, Emergency Spillway Approach Channel
In Foreground**



PHOTO 2. Downstream Embankment, Rock Toe Drain

UNIMIN FRESH WATER DAM



PHOTO 3. Seep from Rock Toe Drain

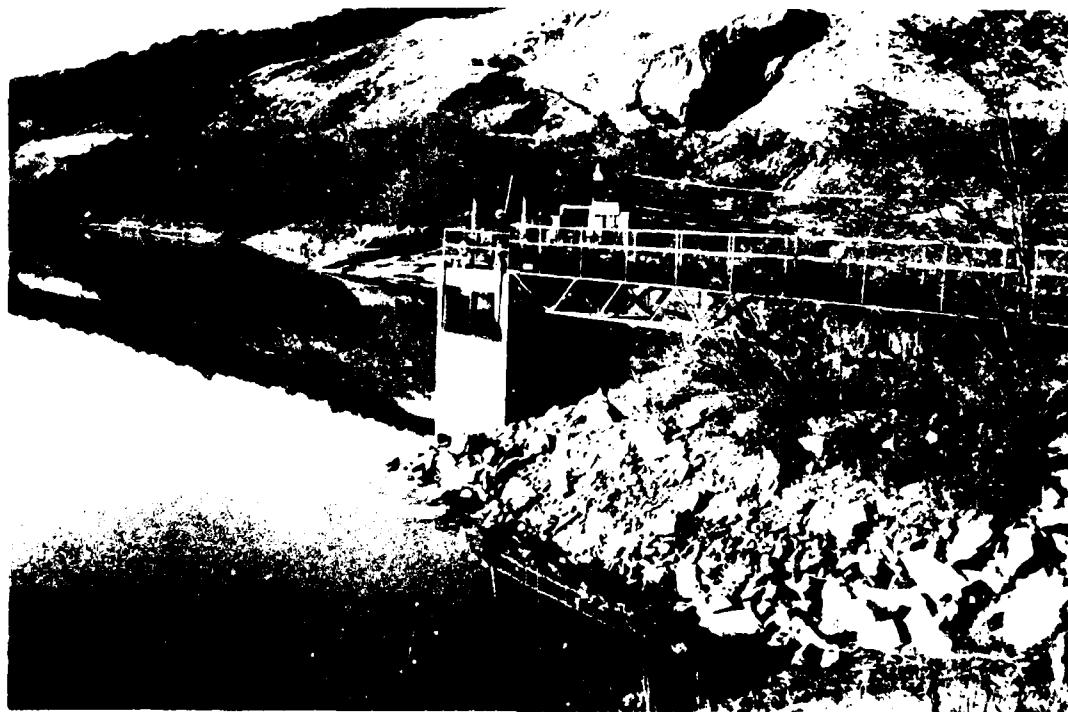


PHOTO 4. Riser for Principal Spillway and Pump Platform

UNIMIN FRESH WATER DAM

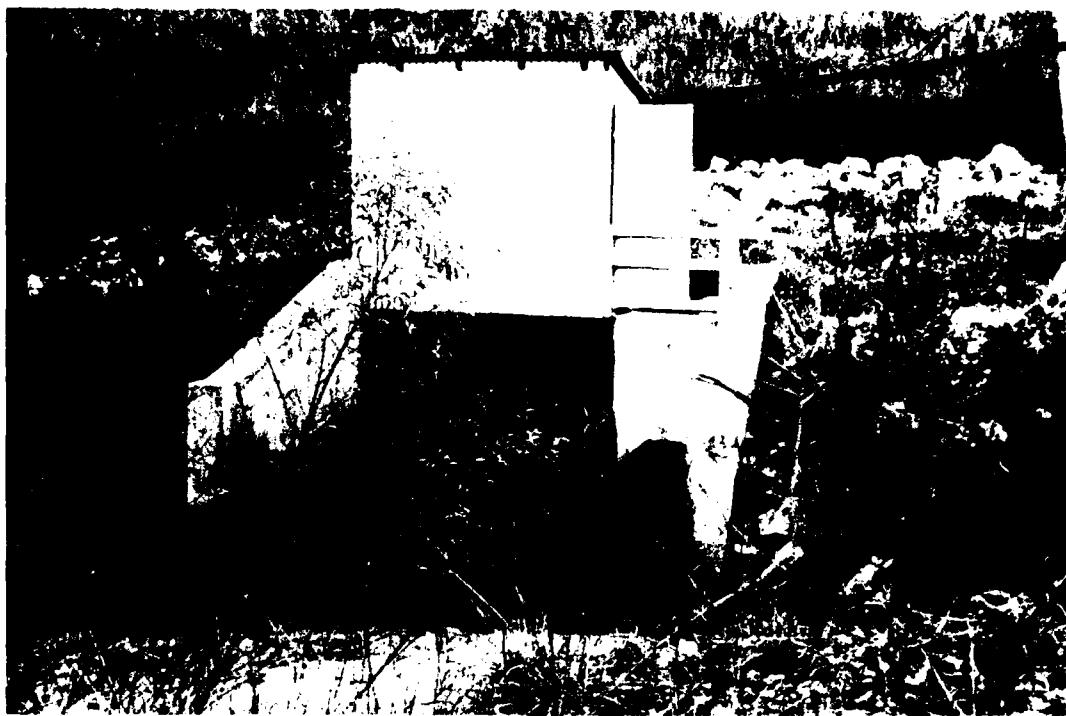


PHOTO 5. Principal Spillway Outlet



PHOTO 6. Emergency Spillway Control Section and Approach Channel

UNIMIN FRESH WATER DAM



**PHOTO 7. Erosion of Shale Bedrock in Emergency Spillway
Discharge Channel**



**PHOTO 8. Unimin Tailings Dam Upstream of Unimin Fresh
Water Impoundment**

APPENDIX III
VISUAL INSPECTION CHECK LIST

Check List
Visual Inspection
Phase 1

Name of Dam Unimin Fresh Water Pond Dam County Frederick State Virginia Coordinates Lat. 3914.8

Long. 7820.3

Date of Inspection 30 and 31 October 1980 Weather Cloudy Temperature 50° F.

Pool Elevation at Time of Inspection 1022.7 ft. T.B.M. * Tailwater at time of Inspection 994.1 ft. T.B.M. *

*Elevations were referenced to a Temporary Bench Mark (T.B.M.) located on the top of the right wingwall on the downstream side of the concrete impact energy dissipator. The assumed elevation is 1000.0 ft.

Inspection Personnel:

Michael Baker, Jr., Inc.:

David J. Greenwood
Larry A. Diday
David W. Hupe

Virginia State Water Control Board:

Ed Constantine

David W. Hupe Recorder

Name of Dam UNIMIN FRESH WATER POND DAM

<u>EMBANKMENT</u>	<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
SURFACE CRACKS		None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE		None observed	Approximately 30% of the upstream embankment is sparsely vegetated and has some minor erosion from wave action. The downstream embankment is heavily vegetated and has a few saplings and is only very slightly eroded. No sloughing was found on either the embankment or abutment slopes.

EMBANKMENT

Name of Dam UNTIMIN FRESH WATER POND DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST

BIPRAP FAILURES

III-3

EMBANKMENT MATERIALS

The outer embankment materials are very shaly. The embankment materials are expected to be largely silty in nature with abundant shale fragments. The embankment was dry at the time of inspection.

There is no information available on any possible zoning of the embankment or on the existence of a keyway or impervious core

EMBANKMENT

Name of Dam UNIMIN FRESH WATER POND DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The junctions of the embankment and abutments appear to be in good condition, with no evidence of erosion.	
ANY NOTICEABLE SEEPAGE	A small seep is located to the right of the principal spillway outlet. It is flowing at about 3-5 g.p.m.	The seep should be examined at regular intervals and after periods of heavy rain for turbidity and/or increase in flow, which may indicate the potential for piping of embankment material. If turbidity and/or increased flows are noted, a qualified geotechnical engineering firm should be retained to perform a stability check of the dam.
STAFF GAGE AND RECORDER	None	
DRAINS	Coarse rock rubble lines most of the toe of the dam and forms a rock toe drain. No drain outlets were found.	

OUTLET WORKS

Name of Dam: UNIMIN FRESH WATER POND DAM

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No cracking or spalling was observed. The concrete appears to be in good condition.	
INTAKE STRUCTURE	The principal spillway for the dam is a square shaped concrete tower with a spillway intake consisting of two rectangular openings. The openings, having vertical upstream and downstream faces, are located on the reservoir and emergency spillway sides of the concrete tower, and are 4.8 ft. and 10.2 ft. long by 4.4 ft. high, respectively. Trash racks partially cover the openings.	The concrete in the principal spillway appears to be in good condition with no cracking or spalling. Larger trash racks should be installed to cover the entire inlet openings.
OUTLET STRUCTURE	Water flowing through the openings falls into a concrete well and then passes under the dam through a 36 in. diameter concrete pipe. The pipe outlets to a concrete impact energy dissipator with a pump house constructed on top. Water then passes over a 12 ft. long concrete weir and flows into a natural stream channel.	The concrete in the outlet structure appears to be in good condition with no cracking or spalling.
OUTLET CHANNEL	The outlet channel is a natural stream channel.	Additional riprap should be added below the energy dissipator.

Name of Dam: UNIMIN FRESH WATER POND DAM

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
EMERGENCY GATE	<p>Three "Rodney Hunt" liftgates are located on the concrete intake tower. Two liftgates are intakes for the water supply sump and the third is a drawdown gate for dewatering the reservoir. Controls for the liftgates are located on top of the concrete intake tower and are reached by means of a steel catwalk extending out from the upstream top of the dam to the intake tower.</p>	<p>The liftgates are in good condition.</p>

Name of Dam: UNIMIN FRESH WATER POND DAM

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

CONCRETE WEIR

None

APPROACH CHANNEL

The emergency spillway is a vegetated earth trapezoidal channel adjacent to the right abutment of the dam. The approach channel is broad and unobstructed. The spillway is well vegetated with grass except where shale is exposed. Although vegetation over the shale is sparse, no significant erosion or sloughing has occurred, nor appears likely.

A good grass cover should be maintained.

III-7

DISCHARGE CHANNEL

The discharge channel of the emergency spillway is well routed downstream of the dam. It has a small ditch eroded to bedrock but is not a hazard to the dam. The channel is vegetated with grass and brush.

All areas of erosion should be filled, graded, compacted, and seeded. The brush should be cut off at ground level and a good grass cover established over the disturbed areas.

BRIDGE AND PIERS

None

INSTRUMENTATION			
NAME OF DAM:	UNIMIN FRESH WATER POND DAM	REMARKS OR RECOMMENDATIONS	
VISUAL EXAMINATION	OBSERVATIONS		
MONUMENTATION/SURVEYS	No permanent markers were found.		
OBSERVATION WELLS	None		
WEIRS	None		
PIEZOMETERS	None		
STAFF GAGE	None observed	A staff gage should be installed to monitor reservoir levels above the normal pool.	

Name of Dam: UNIMIN FRESH WATER POND DAM
RESERVOIR

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
SLOPES	<p>The reservoir slopes are steep and wooded except where mining operations are in progress on the left side of the reservoir. The slopes that are wooded appear to be in good condition, with no evidence of erosion. The slopes where mining operations are in progress are heavily eroded.</p>	
SEDIMENTATION	<p>Some sediment buildup is evident on the left upstream side of the reservoir where mining operations are in progress. Soundings at the intake tower indicate a water depth of 18 ft. below the pool during the inspection.</p>	

DOWNSTREAM CHANNEL
Name of Dam: UNIMIN FRESH WATER POND DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	There is some minor debris, a small pile of junk and a trailer, present in the natural channel just downstream of the dam.	The debris and obstructions should be removed from the downstream channel.
SLOPES	The downstream channel is a natural stream channel and has about a 2% slope. The channel side slopes are somewhat steep and covered with trees and brush.	
APPROXIMATE NO. OF HOMES AND POPULATION	Three homes are located approximately 4,000 ft. downstream of the dam. A business, C.M. Minerals, is located about 5,000 ft. downstream and three more homes are located approximately 6,500 ft. downstream of the impoundment. These structures are located from 10 to 15 ft. above the stream bottom.	

APPENDIX IV
GENERAL REFERENCES

GENERAL REFERENCES

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NAME OF DAM: UNIMIN FRESH WATER POND DAM

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NAME OF DAM: UNIMIN FRESH WATER POND DAM

